Bi-modal distribution of substorm intensity

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One of the essential issues in substorm study is how is the substorm intensity distributed and what determines the distribution. In this study, the substorm intensity (AL index at substorm) distribution is statistically studied using the Wp index provided by WDC for Geomag, Kyoto University and OMNI data base. The results showed that substorm intensity distribution is composed of bi-modal peaks with lognormal distribution. The major peak is in small AL range around 100 nT (named group-S substorm) and the secondary peak is around 300 nT (named group-L substorm). The bi-modal distribution of substorm intensity means that substorm is not a continuum state between pseudo-substorms and full substorms as has been discussed. The solar cycle variation of the substorm intensity distribution showed that group-S substorms occure rather constantly during a solar cycle, whereas the appearance of group-L substorms is strongly dependent with the solar activity. These observations suggest that two different substorm processes are working in the magnetosphere or different solar wind-magnetosphere interaction processes are operating.

Keywords: substorm, intensity distribution, lognormal distribution

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